**Vision Clinical Correlates**

**Cataracts**

* A clouding of the normally clear lens of your eye
  + Makes it more difficult to read, drive a car, recognize people
* Generally don’t cause surface irritation or pain
* Pathophysiology
  + Normally a lens is mostly made out of water and protein fibers, but they are aligned in such a way that makes the lens clear and allows light to pass through without interference
  + With again, the composition of the lens undergoes changes and the structure of the protein fibers break down
    - This causes them to clump together, clouding parts of the lens
  + Reason for age-related changes is not exactly known
    - Might be due to general wear and tear
    - Also might be caused by unstable molecules known as free radicals
* In Young People
  + No matter how it develops, can affect brain development is left uncorrected
    - Result in one eye having ocular dominance
  + Congenital
    - In 25% of these kids, typically due to a metabolic disorder or a chromosome abnormality
  + Acquired
    - Trauma, diabetes, poisoning, steroid use, and others

**Retinitis Pigmentosa**

* Group on inherited diseases that affect the retina causing degeneration of photoreceptor cells
  + As the cells degenerate and die, patients experience progressive vision loss
* Common feature
  + Even though it’s a gradual degeneration, typically rods are affected first
  + First symptoms are night blindness because rods are affected first
  + Eventually develop tunnel vision because the rods make up most of the periphery, and with their death, there is no input from the surrounding

**Optic Neuritis: Glaucoma**

* Risk factors
  + >40 years old
  + Family history of glaucoma, migraines
  + High IOP (intra-ocular pressure)
* Pathophysiology
  + IOP is vital in maintaining constant eye geometry and keeping optical properties and structures correctly aligned
  + With the outflow of aqueous humor blocked, this can cause damage to the optic nerve
* Normal Tension Glaucoma
  + CN 2 damage without elevated IOP
  + Typically older women (age 60) are affected
    - Generally 10 years older than patients with high-tension glaucoma
  + Can be treated with drugs as well, only if detected early
* Detection
  + High pressure Glaucoma
    - Test the IOP
  + Normal tension glaucoma
    - Using a motion-sensitive test to detect large peripheral M-type RGC loss since they have the largest and most vulnerable axons and are the first axons to be lost

**Optic Neuritis: Multiple Sclerosis**

* The difference in this from glaucoma is that in the early stages, MS may cause loss of acuity from any position, NOT just the periphery
  + Loss also may only be temporary
  + M and P cells are both potential targets for early stage MS demyelination

**Macular Degeneration**

* Two types, Dry and Wet AMD
* All patients initially have dry AMD
  + Development and accumulation of drusen, localized deposits of extracellular material that appear as yellow spots in the retina
  + As it progresses, focal areas of atrophy of the RPE appear
* Wet AMD
  + Develops in some patients with established dry AMD
  + It is the growth of abnormal vessels beneath the RPE
  + These vessels typically exude plasma and are likely to hemorrhage
* The prevalence of AMD is rapidly increasing in the US with numbers likely to increase by 50% by the year 2020
* Morbidity
  + Quality of life is significantly reduced
* Common risk factors
  + >60 years old
  + Family history/genetics
  + Women are more likely to get AMD
* Treatment
  + Current goal is to stop or slow disease progression because loss cannot be corrected
  + Antioxidant and zinc supplementation has been shown to significantly reduce dry AMD
* Treatment for wet AMD
  + Occluding leaky CNV capillaries
    - Thermal laser photocoagulation of vessels – no longer used due to significant patient vision loss
    - Verteporfin Photodyanmic Therapy – does not lead to permanent and complete occlusion of the CNV
  + Limiting CNV proliferation
    - Since new vessel growth is mediated by vascular endothelial growth factor, control over this is the key
    - Pegatanib sodium – approval to antagonize VEGF
    - Antibodies are currently being tested

**Diabetic Retinopathy**

* Risk factors
  + African and Mexican Americans have a higher prevalence of diabetes, leading to greater percentage with this disease
  + Increase in diabetes in children is also concerning
  + Duration of diabetes
    - Longer the duration, the greater the risk
  + Severity of hyperglycemia
    - Key alterable risk factor that helps control progression from earlier to later stages of retinopathy
  + Hypertension management has also been demonstrated to slow retinopathy progression
* Typically develops to some degree in all patients with diabetes
* Earliest clinical observation
  + Microaneurysms and hemorrhages on the retina
* Later stages include closure of arterioles and venules and proliferation of new vessels
  + This increased vasopermeability results in retinal thickening during the course of diabetic retinopathy
* Visual loss mainly occurs from macular edema, macular capillary nonperfusion, vitreous hemorrhage and distortion or traction detachment of the retina
* Two stages
  + Background diabetic retinopathy
    - Arteries in the retina becoming weakened
    - They leak and form small, dot-like hemorrhages leading to swelling and edema in the retina and decreased vision
  + Proliferative Diabetic Retinopathy
    - Circulation problems cause areas of retina to become ischemic
    - New fragile vessels develop to maintain adequate oxygen levels
    - These vessels hemorrhage easily causing blood to leak into the retina and result in decreased vision
  + Later stages
    - Continued abnormal vessel growth and scar tissue may cause serious problems such as retinal detachment and glaucoma
* Treatment
  + Laser photocoagulation surgery is the standard technique for treating diabetic retinopathy
    - Less problematic than in macular degeneration because diabetic retinopathy is less likely to include the macula
  + Virectomy – surgical removal of some vitreous humor